

## Understanding Ionic Liquid Pretreatment of Lignocellulosic Biomasses

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Pretreatment of biomass is essential for breaking apart highly ordered and crystalline plant cell walls and loosening the lignin and hemicellulose conjugation to cellulose microfibrils, thereby facilitating enzyme accessibility and adsorption and reducing costs of downstream saccharification processes. Recent reports<sup>1, 2</sup> have shown very high yields at very low enzyme loadings. However, pretreatment still remains one of the most costly steps in lignocellulosic biofuel production. Ionic liquids are novel solvents showing great promise for lignin and cellulose solubilization. Instant rejection of dissolved polysaccharides upon addition of anti-solvent shows promise for recyclability in addition to other desired attributes like low volatility, non-flammability and thermal stability.<sup>3,4</sup> Although ionic liquids have been shown to be very effective in cellulose solubilization<sup>3,4</sup>, the disposition of hemicellulose and lignin are not fully understood. The aim of our research is to develop a fundamental understanding of ionic liquid pretreatment by monitoring and analyzing process streams. To that end, we have employed HPAEC, XRD, FTIR, NIR, and SEM to study the impact of ionic liquid pretreatment on switchgrass and corn stover. We will present the results from these measurements in the context of developing and selecting optimized ionic liquid pretreatment conditions for selective depolymerization of either cellulose or lignin, whereby fractionation of different cellulosic and lignin components could be realized.

1) Teymouri, F., Laureano-Perez, L., Alizadeh, H., & Dale, B. E. (2005). *Bioresource Technology*, 96, 2014–2018. 2) Kim, T. H., Kim, J. S., Sunwoo, C., & Lee, Y. Y. (2002). In 24th Symposium on Biotechnology for fuels and Chemicals. 3) Dadi et al, *Applied Biochemistry and Biotechnology*, 136-140, 407 4) Singh, S. & Simmons, B, In-Situ Examination of Biomass Dissolution and Cellulose Regeneration Enabling Cellular level Insight of Ionic Liquid Pretreatment Process (manuscript in preparation)